King County
Department of Judicial Administration

Electronic Court Records (ECR)

APPENDIX 5:
Project Integration Strategy

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SJI State Justice Institute

This document by Cary Information Consulting (CIC), the Department's technology consultant, whose County funded support made up the required match for the State Justice Institute (SJI) grant, provides an overall architectural plan for Electronic Court Records (ECR) for the King County Superior Court. This plan also provided substantial insight into the technology available and technological issues to consider in preparing the RFP to obtain systems to implement ECR. A key theme in this strategic overview of ECR is the steps to be taken to integrate all aspects of the project, including local and state legacy systems as well as new systems and services.

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KING COUNTY ELECTRONIC COURT RECORDS (ECR)

CONSULTING CONTRACT: DELIVERABLE NO. 7

Presented to King County under Personal Services Contract.

> **DELIVERABLE NO. 7:** *Written description or conceptual model of the revised architectural plan for ECR, pointing out the components and costs to implement it in the Department of Judicial Administration (DJA). The description will clearly identify components, describe the relationships among them, and explain why each is recommended. Options and Alternatives, if any, will be noted. Include an explanation of how the architecture meets the need to have open systems and the capacity for interoperability. Further (as originally defined in Deliverable #5), contractor will build a detailed listing of the equipment, software and other services required to install ECR in DJA, along with prices (cited in a standard way to facilitate comparison), taxes, and other costs. Alternatives to first-choice components also be identified, with costs.*

1. MANAGEMENT SUMMARY:

THE SCANNING PILOT PROJECT:

The scanning pilot project implemented in November 1997 necessarily contained a number of system architecture decisions. Although the intent was to implement a pilot project without compromising the design of the actual ECR system, some decisions probably will influence the final design, a prime example being the decision to use the ITS owned IBM RS/6000 server located in the Key Tower and centralize storage in the same location.

The Scanning Pilot project has already proved feasibility of several aspects of the ECR plan and has provided enough information to help DJA make systems choices. For example, it has demonstrated or proven the following:

- It is feasible to base a large scale ECR system on the King County Local Area Networks (LAN) and the County Wide Area Network (WAN).
- Scanning can be done in multiple locations and stored in one place. (The test did not specifically prove that scanning can be done in multiple places since all scanning was done in RJC, but scanning was done on multiple scanners and there is no logical

reason that scanning can not be done in multiple places as well. The ImageX system used in the pilot project scans simultaneously on over 30 scanners in 6 or more locations in Riverside County, CA Superior Court.)

- Scanning can be done in large volume and moved across the networks. Volumes of up to 35,000 pages per day have been scanned and sent across the network indexed into the server and placed in magnetic storage. CIC believes that the only government system in Washington State that has equaled this production rate is the Department of Labor and Industries.
- Images located centrally can be retrieved from multiple places, at high speed. Retrieval times are between 1.4 and 4 seconds, whether at RJC or the Court House. This may be contrasted with the 30 to 40 seconds or more required at Records and Elections.
- Images can be written to a CD for distribution.
- Microfilm from scanned images can be made at an acceptable quality.

The Pilot project has also raised some issues:

- Scanning and conversion of the scanned images to microfilm may not be the best way to convert the backlog of closed case files. It may be more cost effective to film them directly from the source documents. On the other hand, scanning active records and converting them to film later, after the case is closed, is feasible.
- At the time of this writing, the scanning software is operating satisfactorily but it took a long time for it to become stable and complete.
- At the time of this writing indexing was not done at the document level.
- At the time of this writing, transfer of images from RJC to the RS/6000 and into the imaging server were too slow. This needs to be improved.
- Installing the pilot project has demonstrated the need to add more technical management strength to the project team. Just the scanning and indexing portion alone has been a management challenge. The entire system will add many more challenges. Challenges such as were encountered in the scanning pilot probably will be encountered no matter which vendor(s) is chosen for ECR.

Conclusions from the Scanning Pilot:

CIC believes that the pilot project system now in place, although incomplete, in essence fulfills most of the features required in phase one, (the core phase of ECR). The final system selected must perform at least as well as this system.

RFQ/RFP:

An RFQ has been released to rapidly arrive at a short list of qualified vendors with whom DJA will discuss the project goals and requirements. Then an RFP will be developed setting forth requirements in detail. The winning vendor will be prime or general contractor who will probably form a team of sub-contractors. The winning vendor should be responsible for the system as a whole. The system is not just a group of hardware and software components, but an integrated system designed to perform a function. The contractor should be responsible for the performance of the system. Because of this, contractors will usually have preferred combinations of hardware

and software. Latitude should be given to contractors to allow them to choose or suggest components and combinations. of components.

Overall Architectural Framework:

CIC suggests that the following as the general architecture for ECR.

1. CIC recommends a client server architecture for the ECR system. The document server is the "server" and the workstation PC's are the "clients". Client Server applications are the overwhelming choice for new applications (with the possible exception of Internet or Intranet based applications). The client server model utilizes the already existing County infrastructure including WAN's and LANs and the installed base of PC's. Internet/Intranet solutions may be added or used to enhance the client server architecture.
2. The ECR server is the heart of the system (there could be more than one server). It can be RISC or CISC, (RISC preferred). King County RS/6000 preferred, although DJA should be open minded to winning contractor's suggestions. Server Operating System may be UNIX or NT, UNIX preferred. Again, be open minded to contractor suggestions . Application servers can use UNIX or NT. Client workstations should be a 32 bit system, either Win 95 or NT Client (NT preferred). It would be desirable that system also can be used with Win 3.1 clients to broaden the base of potential users.
3. Storage: The storage medium should be magnetic. CIC recommends against optical storage. Storage of images should be centralized, in accordance with industry trends. The scanning project has already proven the feasibility of this. However, distributed storage at RJC might be desirable for archival storage. CIC recommends network attached storage (NAS), another emerging trend. Hierarchical Storage Management (HSM) software is recommended to manage storage among the media. Long term archival storage should be archival quality microfilm. Microfilm should be made from scanned images via computer output microfilm (COM).
4. The ECR system should be based on an imaging system, better described as an electronic foldering system (EFS). The folders are electronic virtual folders which can obtain various objects. The EFS should manage all the objects in the folder. Indexing should be at the folder and document level. The system must be capable of supporting a variety of objects (document formats) including TIFF images, word processing documents, ASCII, HTML, XML, and PDF. Although the capacity to handle these electronic documents may not be needed initially, during the "core" phase of the project, they will be needed eventually. The contractor must demonstrate that the system is currently capable of accommodating these objects.
5. The ECR system should be integrated with SCOMIS at the screen level. This is known as "image enabling a legacy system". This is a classical and generally successful concept. SCOMIS would be the legacy system. SCOMIS is proven, well supported, and already developed. The integration would be at the PC screen level, using OLE (Object Linking and Embedding) or other method of integrating the folder in the image window(s) with the SCOMIS file in the mainframe emulation window In other words, the SCOMIS window and the ECR window would appear simultaneously on the screen, and would be linked with common index terms, which would be the SCOMIS case number and document sub-number.

A search could be done in SCOMIS, the desired case brought to the SCOMIS screen and the corresponding documents from the ECR system would come up in the image or document window. Images also should be accessible without SCOMIS or by integrating with other data bases or applications (such as CMIS and CRIMS).

6. Workflow software will be required to move the objects from work point to work point using pre-established routes and to perform certain tasks. The workflow software can be part of the EFS (imaging system) supplied by the imaging vendor or a separate piece of software supplied by another vendor. The Workflow system must be robust enough to handle the ECR requirements. ECR requires is a high volume, medium complexity workflow system. The workflow system should interface with MS Exchange.
7. Data upload. During subsequent phases of ECR, data must be captured and entered into SCOMIS (automatic docketing). The contractor must demonstrate the software to do this is available or can be developed. DJA should consult with OAC when implementing automatic or semi-automatic uploading.

COST:

CIC believes that cost estimates used so far in planning may have to be revised upwards. The imaging (EFM) software and workflow software may be more expensive than predicted. A prime contractor will require a markup to cover the costs of integration, systems development profit and risk. As a rule of thumb, contractor markup is about 35% above the cost of hardware, software and first year maintenance.

Costs could be controlled by phased build-up and by selective postponement of costly features. For example, sealed records could be left on paper for now.

The ECR project is very large. The only governmental imaging system in Washington State of comparable size and volume is at the Washington State Department of Labor and Industries, in Tumwater. The L&I system supports about 800 users and scans about 9K documents per day (compared to DJA 7K per day). The L&I system cost between $16 and $20 million dollars, which is much more funding than is available to DJA. DJA will utilize the greater power and cost efficiency of today's hardware and software to install ECR at a fraction of the cost of the L&I system. Nevertheless, ECR is a large and complex project and we must not underestimate the cost and expense of acquiring, integrating and managing this system.

II. METHODOLOGY:

As a basis for planning CIC began with the 1996 ECR budget, the Scanning Pilot project budget, the 10 year planning document (D#2) and most recent ECR program planning budget. These were compared with the architecture and cost estimates developed in this deliverable.

Knowledge gained in earlier deliverables of the ECR contract was factored in. For example, D#4, a comparative study of the experience of other courts in implementing electronic records provided knowledge useful in planning ECR architecture. D#3 gathered and analyzed data about the probable usage of ECR by other King County criminal justice departments and offices. This information was used in planning the size (scale) of the core ECR system.

Robert Cary of CIC is a member of EmTAG, the Emerging Technology Advisory Group of AIIM International. He is on the EmTAG storage committee, in which capacity he obtained valuable current information from industry leaders on trends and strategies for large scale storage of images and electronic documents. This information was used for planning storage requirements and strategies.

The Scanning Pilot Project, put into operation in the 4th quarter of 1997, provided considerable experience and knowledge which was used in developing the proposed architecture for the ECR core system. CIC was involved in the planning (D#1) and the acquisition (D#8a) of this project. In addition, CIC helped the ECR Project Manager evaluate some of the results. Exhibit 1, "First Steps into Electronic Court Records, the Significance of the 1997 Scanning Project" is a CIC document developed with the ECR Project Manager summarizing the purpose, value and significance of the project. It outlines the points to be proven and the questions to be answered by experience gained by conducting this project.

For example, computer output microfilm (COM) is a key feature of the proposed ECR architecture. In January 1998 CIC arranged for a service bureau to create microfilm images from electronic images. This experiment was used to test the quality of the film output, speed of conversion, and ease of managing the process. This test compared the results of 200 dpi scanning with 300 dpi scanning. This difference in resolution has major effects on scanning speed (labor costs) and storage requirements. (See Exhibit 2 for details). With the approval of the Project Manager, CIC invited Fred Westfall, Weyerhaeuser Microfilm Manager, and Sidney McAlpin, retired Washington State Archivist, to help evaluate the results. The resolution of 300 dpi was superior to 200 dpi, but only marginally so. For all practical purposes, 200 dpi has sufficient resolution with the exception of very fine print and other special cases such as finger prints. Fine print and finger prints actually were not very legible at any dpi level nor with any microfilm method tested. However, the DJA archival microfilm process has been long ago approved and accepted. CIC recommends that in the case of finger prints, DJA form a committee to study the requirements. The solution may very well be that hard copies of finger prints must be maintained.

CIC arranged for an experiment at the Department of Labor and Industries (L&I), where the L&I Kodak 930 scanners were used to scan DJA documents to see if these expensive scanners would provide superior results, in particular reduction of paper jams in the paper handling mechanisms. Although only a few hundred documents were scanned, there did seem to be a significant improvement in paper handling. Only one jam was encountered, and this was from an onion skin document. The L&I scanning operation was found to be extremely well managed. However, it must be remembered that the L&I system cost over $16 million dollars, not counting planning and analysis which cost another one to four million dollars. The scanning equipment and software alone cost about $300,000. DJA does not have that kind of money and must strive for similar results with far smaller resources. For example the DJA pilot project imaging software was rented for $1000 per month whereas the L&I imaging software probably cost over $1 million.

CIC did research on jogger boxes to improve the efficiency of archival scanning. We arranged for such a jogger box was brought into the DJA at the RJC for a short trial. It appeared to help with

scanning and with lining up paper files for returning them to their file folders. We did research on sources and prices of various jogger boxes and gave them to DJA.

CIC worked with various vendors to get up do date offerings on software and hardware, including prices and capabilities.

Taking account of all information received during the past year, and also taking into account the amount of funding available, CIC developed the proposed architecture described in Section III, below. The attached spread sheet (Exhibit 3) provides estimated costs for the main components when these costs differ widely from earlier planned costs.

Versions of this document have been shared with DJA over a two month period. The final document is a result of an iterative process by both CIC and DJA.

III. ARCHITECTURE

A. INTRODUCTION

Acquisition Strategy:

DJA's system acquisition plan is a fast track strategy. An RFQ will be released to rapidly arrive at a short list of qualified vendors with whom DJA will discuss the project goals and requirements in detail. Then an RFP will be developed setting forth requirements in detail. The winning vendor will be prime or general contractor who will probably form a team of sub-contractors. For example, an imaging company might ask a local value added retailer (VAR) to act as the prime contractor, or it might act as the prime contractor itself.

The winning vendor will be responsible for the system as a whole. Imaging and document management systems rarely work "off the shelf". The system is not just a group of hardware and software components, but an integrated system designed to perform a function. The contractor should be responsible for the performance of the system. Because of this, contractors will usually have preferred combinations of hardware and software. Latitude should be given to contractors to allow them to choose or suggest components and combinations. of components.

On the other hand, DJA will wish to specify certain components of the architecture and set an overall framework within which the contractor may select and organize sub-components. CIC suggests that the following overall framework. In subsequent sections, CIC will suggest hardware and software components, noting where these suggestions should be considered essential or mandatory.

Proposed Overall Architectural Framework:

1. CIC proposes a client server architecture for the ECR system. The document server is the "server" and the workstation PC's are the "clients". Client Server applications are the overwhelming choice for new applications (with the possible exception of Internet or Intranet based applications). The client server model utilizes the already existing County infrastructure

including WAN's and LANs and the installed base of PC's. Internet/Intranet solutions may be added or used to enhance the client server architecture.

As an example, in the present scanning pilot project, the RS/6000 is the server, and the PC workstations are the clients. The server (application server) manages the images and indexes and the clients manage the display logic including screens, decompression and display of images. To better understand this, contrast it to a mainframe model such as SCOMIS. The mainframe manages the data and indexes and also the display logic. That means that even the SCOMIS screens displayed on the terminals are actually sent each time from the mainframe. That is why they call them "dumb terminals". Client server systems are a teamwork of components, each doing what they do best. This reduces traffic on the network.

2. Server Operating System may be UNIX or MS NT Server, UNIX preferred, but DJA should be open to vendor suggestion. Application servers can be UNIX or NT. Client workstations should be NT Client or Win 95, NT preferred. It would be desirable that system also can be used with Win 3.1 clients to broaden the base of potential users.
3. The ECR system should be an electronic foldering system (EFS). The folders are electronic virtual folders which can obtain various objects. The EFS should manage all the objects in the folder. Indexing should be at the folder and document level. The system must be capable of supporting many objects (document formats) including TIFF images, word processing documents, ASCII, HTML, XML, and PDF. DJA may specify which formats it will accept.

   If a wide variety of formats are not to be supported, then the documents must be converted by the ECR system to the format(s) which will be supported. For example, Federal Bankruptcy Courts convert all formats to Adobe PDF. Whether the documents are filed as paper and scanned, or arrive as word processing documents, or as HTML, they are converted to PDF. Thus, the courts and the remote users need only have Adobe Acrobat to view them. The Acrobat viewer can be downloaded over the Internet, currently at no cost. Alternatively, the San Francisco County and City Superior Court converts document formats to TIFF images (see Deliverable 6 for details).

4. The ECR system should be integrated with SCOMIS at the screen level. This is known as "image enabling a legacy system". This is a classical and generally successful concept. SCOMIS would be the legacy system. SCOMIS is proven, well supported, and already developed. The ECR system would be integrated with SCOMIS at the PC screen level, using OLE (Object Linking and Embedding) or other method of integrating the folder in the image window(s) with the SCOMIS file in the mainframe emulation window. The SCOMIS window and the ECR imaging window would both be open on the screen at the same time interactively related by common index terms. The SCOMIS Number (cause number) and sub-number (document number) are unique key field (indexes) into the ECR document repository. These two key indexes are used in common by SCOMIS and ECR.

   Image enabling has several benefits: it extends the life of existing investments in line-of-business applications, minimizes training/retraining by providing an incremental change, and provides seamless information retrieval.

Images also should be accessible without SCOMIS, using the ECR system alone, or by integrating with other data bases or applications (such as CMIS or CRIMS).

5. Workflow software will be required to move the objects from work point to work point using pre-established routes and to perform certain tasks. The workflow software can be part of the EFS (imaging system) supplied by the imaging vendor or a separate piece of software supplied by another vendor.

ISSUE: Grand solution or Limited Solution?. Should a combined architecture from one vendor be chosen, not only for DJA but for other criminal justice agencies?

There has been discussion about acquiring a suite of document solutions. For example a County wide site-license could be obtained from a major document management vendor such as File Net. This would permit an integrated suite of document management solutions for multiple agencies of the county. It could include imaging, document management, workflow, and COLD. DJA itself does not need Document Management, or COLD. See recommendations 2, below.

NOTE: Document Management means software that manages a document library, keeping track of revisions, renditions, charge out, document origin and ownership and is used especially by attorney firms to manage document creation. This is not needed by DJA which generally files, not creates, documents. Saros (FileNet), PC Docs, Open Doc, and Soft Solutions are examples of document management systems.

NOTE: COLD stands for Computer Output Laser Disk. This technology is used to put computer output reports on a special server and make them available to users on the LAN.

6. The system should be as open as possible. That means that it should depend as little as possible on any single vendor. In other words it should be non-proprietary. This ideal is not entirely practical however. For example, it is probable that all the client PC's will be running Microsoft Windows (WIN 95 or NT) which means they are proprietary.
7. DJA should have an exit strategy. DJA must be able to convert the system to another system if necessary. If a vendor goes out of business or does not provide adequate service, the County must be able to export documents, images and index data to another system . Provision for this must be a requirement built into the contract. This is best done by maintaining data in vendor neutral formats, which will help minimize switching costs. Such a strategy entails use of industry and de facto standards as applicable to address storage media, scanning quality, image files headers, and compression techniques.
8. Standards: The Association of Information and Image Management (AIIM) as the authorized document management body for the American National Standards Institute (ANSI), has developed many industry standards pertaining to imaging and document management.

The following standards are important in document management:

- Open Document Management API (ODMA) is an API (Application Program Interface) specification that assigns a document ID which is then forwarded across various server platforms. It is based around creating interpretable document management application on the client side of the network. ODMA is an AIIM standard.
- Document Management Alliance (DMA) is a specification what defines enterprise-wide document management library services. DMA is a middleware layer specification that allows access to and search for documents between different document management systems. DMA may not be important to DJA's ECR but may eventually be important to the County's ability to provide universal access.
- Document Header Standards: See Software, Imaging, below.
- Compression Standards: See Software, Imaging, below.
- Workflow Management Coalition (WfMC). See Software, Workflow, below.

9. The system should be fault tolerant to the greatest possible degree. Hundreds of people may be using the system simultaneously. People will depend upon the system to do their work. A system failure would put people out of work and shut down court operation causing significant consequences.

Recommendations:

1. DJA should choose the limited solution. It should acquire what it needs for internal operations and not try to forge a County standard. Although it might be desirable for other departments to use the same imaging and workflow software, it would take too long to obtain combined decisions, and the delay might jeopardize the ECR program.
2. DJA should not acquire a suite of programs. For example DJA does not require document management software such as Saros (FileNet) or PC DOCS, which can be part of a suite. This kind of software is designed primarily for those creaking vast numbers of documents, such as a legal firm. DJA on the other hand receives and files documents, which has different requirements than document creation.

B: FUNCTIONAL PERFORMANCE REQUIREMENTS:

The ECR system is a combination of hardware and software. Specific functional and performance requirements are stated in D, Hardware Requirements, and E, Software Requirements, below. General performance requirements, involving both hardware and software are described here in this section.

Overall Functional Performance Requirements:

Input:

1. System must be able to scan at least 10K documents, (40K pages) per 8 hour work day. Present average document filing is about 6K documents (28K pages) per day, but there are peaks and valleys above and below the average number.

2. System must be able to support multiple scanners (12-20) simultaneously. Required volume of 10K documents represents combined output of all scanners. System must support multiple scanners while supporting users (see Access, below).
3. System must be able to accept FAX documents. In effect, the filer creates the image and sends it, not paper to the Clerk. The FAX image goes directly into the ECR system without the need for it to be printed out or scanned.
4. System must b able to accept other formats as specified, including Word, Word Perfect and ASCII (from electronic forms), and in later phase, HTML from the Internet.

Indexing:

Indexing for ECR is divided into two categories:

(a) Indexing documents into the system. In other words, adding a key number to each case, document and image so it can be retrieved by the system. In the ImageX system, the key number for each document is the SCOMIS case number. This type of indexing is semi-automatic, done from bar codes. This index is in "Minds", on the RS/6000.

(b) Docketing: This type of indexing is data entry into SCOMIS, done by docketing clerks.

1. System must be able to index, category (a), at least 10,000 documents per day (40,000 pages) in 12 hours. In further phases of ECR, documents will be accepted from FAX, Internet, electronic forms, workflow or other methods which also must be indexed Indexing includes loading images and documents onto the storage system, ready for access.

Docketing. As part of a workflow step, system must be able to present 10,000 documents per day to 40 docketing clerks for uploading data into SCOMIS. During the first phase of ECR, docketing will be manual, data entering from the image. In later phases, indexing of electronic or smart documents will be semi-automatic (a workflow step).

Transportation:

1. System must be able to move documents across the King County WAN. Must be able to move 10,000 documents (40,000 pages) in 10 hours, either batch mode or interactively.

Access:

1. Retrieval speed for first page of a document, assuming WAN speed at normal, should be under 1.5 seconds.

2. System must be able to accommodate 200 concurrent users during initial phases of ECR project. System must be able to scale up to at least 400 concurrent users.
3. System must be able to support 800 users (not concurrent).

Capacity:

1. System must be able to contain 7 million images (50K per image) per year, with three to 4 years on-line. NOTE: CIC has been using 50K per page for estimating storage requirements. However, DJA has measured average page size during the pilot scanning project as 35K or lower. DJA has used the lower number for capacity and cost estimates and CIC agrees with this. However other vendors or systems may require more storage per page than ImageX.

Output:

1. System must be able to print images or other document formats at 10 pages per minute, per printer (normal LAN based printers. In addition DJA needs at least two faster printers capable of 20 or more pages per minute, to print out cases rapidly.

Backup:

1. System must be able to back up 10K documents, (40K pages) and related index data in 12 hours. See software, below. County Information and Technical Services (ITS) has two backup systems available: (1) Normal UNIX backup utilities and (2) ADSM facility involving ITS mainframe. Vendor should evaluate both systems and/or its own backup methodology.

C: REQUIREMENTS FOR INTEGRATION WITH EXISTING SYSTEMS

- **SCOMIS:** System must integrate at the screen level (using OLE or other method) with SCOMIS. See 3,A,4 above for definition of "screen level integration."
- **CMIS:** System must be able to integrate with CMIS. Vendor must be able to work with DJA and the Superior Court to design the interface. Interface can be at the screen level.
- **King County WAN:** System must be able to use the County WAN for transfer and retrieval of documents between departments or geographical locations. This includes mainly the ATM network but also various T1 and other connections.
- **King County LAN's:** System must be able to operate on and across King County LAN's, in particular DJA and the RJC LAN's.
- **King County Internet standards and committees:** In further stages, ECR will probably utilize the Internet. Vendors should show that their system is capable of being extended to the Internet (and any County intranets), both for inputting documents and retrieving and accessing filed documents.

D. HARDWARE

Image Server:

The heart of the system is the image server. This unit manages, indexes, retrieves images and manages the storage. The server must be robust enough to manage multi-terabyte storage; to index 30,000 pages per day; and support simultaneous access by hundreds of users. It must be scaleable as the load on the ECR system is sure to grow. Deliverable #3 predicted that there will be 700 users (200 heavy users) in the criminal justice agencies, NOT COUNTING DJA ITSELF which is expected to comprise 80 users. This also excludes potential external users outside of the County by means of dial-up or the Internet.

The two main options are (1) a RISC (Reduced Instruction Set Computer and (2) a CISC (Complex Instruction Set Computer). RISC "boxes" are made by manufacturers such as Sun, Hewlett Packard (HP), DEC, Unisys and IBM. RISC servers usually use UNIX as an operating system. CISC "boxes" have Intel or Intel compatible processors. CISC servers usually use Microsoft NT as an operating system, although they can use UNIX or IBM OS/2. They are made by many manufacturers such as Compaq, Gateway, Unisys, or ACER. RISC servers are faster, more powerful and more expensive. Some CISC servers can use either UNIX or NT.

ISSUE: RISC or CISC? Should the ECR core system use a RISC server with a UNIX operating system, or a CISC (Intel type) server with MS NT operating system? (CISC servers can also use UNIX).

CIC did research on servers and operating systems as part of Deliverables #1 and #8a. We found no vendors willing to suggest CISC (Intel type) servers for systems used by 300 users or managing over 350 GB of storage Vendors wanted to propose RISC servers running UNIX. In other words, all vendors selling both kinds of servers recommended RISC/UNIX for applications as large and demanding as DJA's. DJA will eventually have hundreds of users, will simultaneously be scanning scores of documents per day from multiple locations, will be backing up data and documents and will maintain thousands of gigabytes (terabytes)of storage.

On the other hand, King County tends to favor the NT operating system for new client server applications. Such systems running on CISC are much cheaper (as a rule of thumb, about 30% cheaper). But, RISC/UNIX servers are more scaleable than CISC/NT servers. That means they can be enlarged to handle a bigger load. The new version of NT, (NT 5.0) will be much more scaleable and will support multiple processors and multiple clusters of processors.

CIC analyst R.C. Cary, as part of EmTAG, attended a high level Microsoft briefing on NT. The briefers were part of the original NT design team. After the presentation, the

consensus EmTAG was that the Microsoft NT will continue to improve and will eventually match UNIX in Scalability and will be much cheaper. This will not happen, however, until at least one or two years from now. (Microsoft recently announced up to a one year delay in release of NT 5.0). Almost without exception, major imaging software vendors are developing NT based offerings. The industry is betting on NT, in the long run.

The decision is a trade off between cost and performance; between guaranteed power now and probable power later.

CIC believes the safest plan is to adopt a RISC/UNIX solution for the initial deployment of the ECR system. The advantages of the UNIX solution are: Proven ability to handle the work load of hundreds of simultaneous users, stability and reliability, and proven ability to handle hundreds of gigabytes, even terabytes of image data. This is the safe decision. Otherwise DJA might install a solution which might appear adequate at first but would not be able to support the load which is sure to develop. Also, the RISC RS/6000 has been used successfully for the scanning pilot project. See recommendations at end of this section.

RS/6000.

King County had acquired an IBM RS/6000 in anticipation of the imaging system needs of DJA and the Recording Division of the Department of Records and Elections. This is a multi-node RISC server, using the IBM AIX UNIX operating system. It is located on the 24th floor of the Key Tower. The system is powerful but expensive.

The DJA Project Manager chose to use this server for the scanning pilot project. The decision was made because of simplicity and reliability. ITS provides a controlled environment and trained operators. ITS would provide backup and manage maintenance. ITS charges DJA for its share of the system cost. See recommendation at end of this section.

Costs:

There would be no increase for the charges now being paid and no increase to the projected and budgeted costs for servers.

CIC recommends continuing to use the RS/6000 for the core system. See Recommendations at end of this section. However, CIC also recommends keeping an open mind to the recommendations of the winning vendor. If an Intel type CISC server is chosen, it must meet the performance requirements listed above.

Intel Based Server.

Another possible strategy is to keep the option open in the future for conversion to CISC/NT. It may also be possible to combine the systems in the future. For example it may be possible and desirable to have multiple servers. Some may be UNIX and some NT. CIC has conducted some recent research on CISC servers. A configuration supplied

by UNISYS (Exhibit 4) would cost somewhere between $35,000 and $43,000. It has 4 Pentium processors expandable to 6, dual cache, 1000 MB of RAM, and a 9 GB hard drive. It could easily act as a second server or possibly as the main server.

Server Recommendations:

Use a RISC/UNIX server at least at first . This will provide the most scaleable platform. It will offer the least risk of the system bogging down under pressure of hundreds of users and millions of documents. This scalability is worth the extra cost. Use the RS/6000 It is supported and maintained by a professional staff in a controlled environment. Costs will be the same as at present.

However, having said that, CIC also recommends keeping an open mind to vendor suggestions. If a non RISC/UNIX server is chosen, however, it must meet performance requirements.

Evaluate, during coming years, whether a CISC (Intel type) server with multiple processors running Microsoft NT would be more cost effective. If it becomes necessary to add a second server (for example for archival scanning and storage), consider using the CISC type server. (This means that the imaging software is able to operate simultaneously and seamlessly with RISC and CISC servers). In about 4 years, when the RS/6000 is nearing the end of its system life, it may be time to convert to CISC/NT, which by that time will more than equal the RS/6000 and will cost much less. Incidentally, ImageX, the present vendor during the scanning pilot, can run on both UNIX and NT and mix the two.

Consider using a second node on the RS/6000 for fault tolerance. That means that should the first node of the RS/6000 fail, the second node would take over and the system would stay up. This feature might be added in the second or third year once the system is established.

DJA might also consider an additional "cache server" which contains copies of cases which are active in court, or will become active in a short time. Users would access documents from the cache server, which presumably would still function if the main server should go down. Of course, the indexes would also have to be replicated, since the main index is on the main server. DJA should discuss this with prospective vendors to see if this is a better strategy than a duplicate node on the main server.

Storage:

General Discussion: The recommended overall storage strategy is: Hierarchical Storage Management (HSM); Network Attached Storage, (NAS); magnetic media for active records; and Computer Output Microfilm (COM) for archival storage and preservation. Storage should be centralized, or at least be located on only one or two places and have a centralized index. Fault tolerance should be a major consideration.

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HSM: Hierarchical Storage Management means software that moves electronic documents and images systematically and progressively from active magnetic storage to

other kinds of storage such as magneto-optical, optical disks, CD's, digital tape and eventually to microfilm. The movement of the documents down the storage hierarchy is determined by business rules established by the ECR project. HSM will be provided by the imaging vendor or a third party.

Some vendors have relatively primitive HSM software, which can only be set to move images from magnetic to optical based on a simple formula such as "when hard disk 85% full, move images to optical, until magnetic disk is only 80% full." Aside from being able to change the percentages, the operator may have no other controls available. Manager could not, for example, say move all cases of such and such a type to optical disk #15. Third party HSM vendors have more sophisticated control over migration of images.

Storage Media:

ISSUE: Should storage be magnetic or optical?

In previous deliverables, CIC has advanced the argument that optical storage is no longer the preferred storage option because magnetic storage is better and faster and because of the decreasing cost of magnetic storage compared to optical This argument is even stronger today in the first quarter of 1998. The cost of magnetic storage has decreased as fast or faster than predicted during the past year, with no end in sight.

There is an argument that optical WORM (Write Once Read Many) is better for long term official records because documents stored on them cannot be altered. Current thought in the imaging industry and in AIIM EmTAG is that this is not a good argument. Security is best obtained by good business practices including passwords, training and supervision.

The scanning pilot project used only magnetic storage. This has resulted in superior performance. Response time for retrieval of documents has been about 1.5 seconds which is very fast considering the images must make several LAN/WAN jumps and travel over 20 miles. If the documents were on optical storage, they would require at least 15 additional seconds for retrieval.

Cost of magnetic storage has been dropping at a compound annual rate of 66% since 1989 and is continuing or even accelerating. Five years ago, storage cost was $10 per MB, two years ago it was $1 per MB. The IBM storage procured for the pilot project was about $.73 per MB. The cost of the next round of storage should be about half of this. CIC proposes a storage solution for the ECR project which will be about $.36 per MB. (See NAS and Fault Tolerance below and attached spread sheet). This is lower than the cost of 5.25 inch optical drives (and much lower than paper). In another year, the price may be expected to drop again. Unisys and other vendors have predicted that Nine GB disks will be replaced in 12 months by 18 and 24 GB disks, at little or no increase in price. In fact, the UNISYS 18 GB disk for the NAS is supposed to be available in April, 1998. The buying strategy should be to buy disk storage in increments as needed, to take advantage of expected price reductions.

Conversion:

There is always the future possibility that images and documents must be moved from the current system to a new one. The new system might be an advanced revision of the imaging and document management software, or it might be to an altogether different system supplied by a different vendor. Experience in conversion of large scale image systems has shown that it is much easier to convert images on magnetic storage than from optical storage.

CIC strongly favors magnetic storage. See recommendations, below. If, however, DJA elects to use optical storage, the following considerations are presented:

Imaging vendors' optical disk implementations have utilized proprietary encoding schemes and files systems to maximize the number of images that can be stored on an optical disk. Recent industry efforts to standardize the file system on optical media has resulted in the development of ISO/IEC 13346, known informally as the Non-Sequential Recording standard, and formally as "Volume and File Structure for Write-Once and Re-write Media Using Non-Sequential Recording. The Optical Storage Technology Association (OSTA) has created the Universal Disk File (UDF), an implementation of ISO/EIC 13346.

UDF has currently been implemented for 5.25" (130mm), 3.5" and Digital Versatile Disk (DVD). CD-ROM disks (120 mm) are covered under the International Standards Organization as ISO 9660.

Location of Storage:

Where should the storage be located? Current thought in the industry is that storage is returning to the centralized data processing shop, reversing earlier decentralization trends. This is in fact what has occurred in the DJA pilot project and it has worked well. King County is able to take advantage of this trend because of its excellent WAN/LAN infrastructure and professional centralized data processing staff and facilities.

> **NOTE**: If large scale archival scanning is continued, an exception might be made for the archival storage. It may be more efficient to have a separate storage facility for archival documents, saving transportation across the WAN and LANs.

ISSUE: Should the DJA acquire additional magnetic disk storage from IBM just because the RS/6000 is made by IBM?

The initial disk storage for the ECR project was obtained from IBM to simplify installation and bring the scanning pilot project on line in a short time. This need not be case for the main ECR system, however. In the data processing industry, most storage is supplied by third party vendors. Third party vendors are usually less expensive. If proper maintenance and service arrangements can be made, there should be no trouble operating and maintaining third party storage. Cost and performance should dictate choice of storage vendors.

NAS: Another trend in mass storage is "Network Attached Storage" (NAS). International Data Corporation (IDC) defines NAS as storage subsystems that are:

Accessible over the network
Shareable resources
Remote from Clients
Predominately used for network storage access.

There are two main elements that differentiate NAS from traditional data storage.

(1) NAS has the added intelligence to provide access to data independent of the operating system or model of the requesting platform and
(2) The storage subsystem is connected to a network or network server, whereas traditional storage is constrained to the connection of just one, or maybe a handful of host CPU's. That means that the storage devices can be located on the network, not directly connected to the server.

If NAS were adopted for ECR, the storage devices would be in the ITS shop in Key Tower, as in the present pilot project, but they would not be connected directly to the RS/6000 server.

CIC has obtained an estimate for a UNISYS NAS unit capable of handling one Terabyte (1000 Gigabytes, or about 3 years worth of storage at 7 million pages per year. This unit is fault tolerant with no single point of failure and the cost is $.37 per megabyte. (See Exhibit 5)

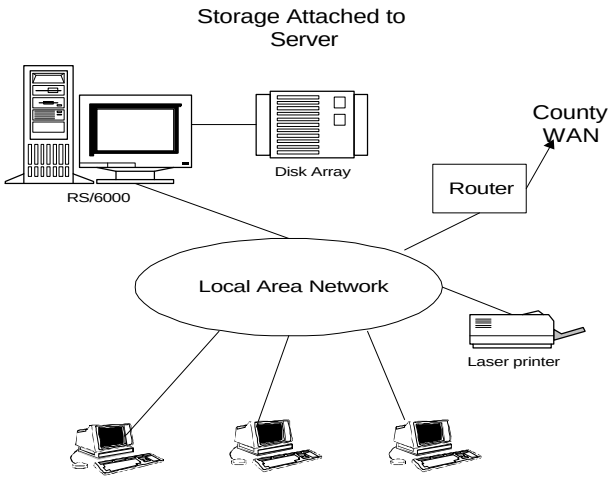

Figure 1: Storage Attached to Server

Figure 2, below shows the Network Attached Storage (NAS) configuration

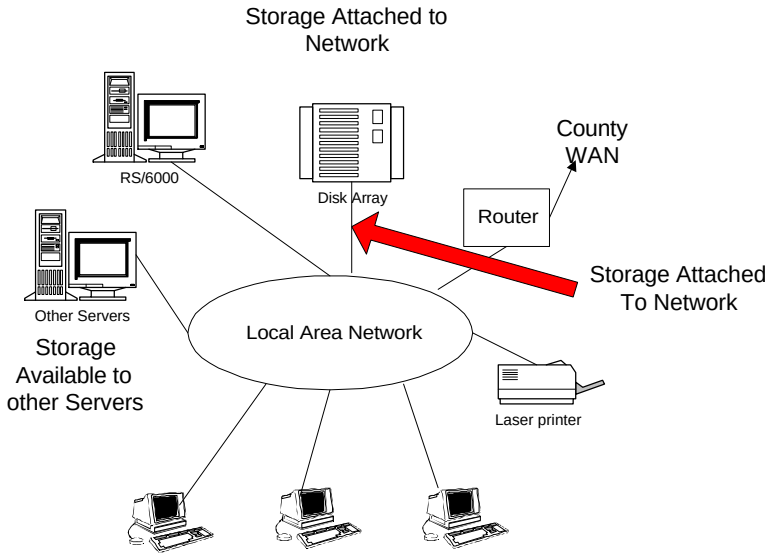

Figure 2:: Storage Attached to Network

Fault Tolerance:

NAS units are now being offered which are extremely "fault tolerant". Disks are configured as RAID 5 or 10 and the NAS unit is designed with redundant components so that there is no single point of failure. This means that there is no single thing in the storage unit that could fail and bring the storage system down. This would greatly minimize the risk of putting dozens or hundreds of people out of work because of storage failure.

Tape Storage:

Robotic tape libraries are now available with massive, low cost storage. Access speeds are increasing and are now in the order of 12 seconds. The document management software should be able to retrieve documents on-line from either the magnetic disk drives or the tape unit. It would just take longer from the tape unit. Tape storage can be added to the ECR system later, in the third year, if needed. HSM can manage the movement of images and electronic documents from the NAS disk storage to the tape library.

Initial assumptions by the Project Manager were that each TIFF image of an 8.5" x 11" page would require 50 K. The scanning pilot project showed that it may be closer to 40K, which would represent a large storage savings.

Microfilm:

Superior Court documents must be retained permanently. DJA must provide storage and access to the records permanently which means that it must preserve both the documents and the index to the documents. Maintaining electronic documents permanently is a two part problem: (1) life of the media, and (2) life of the software and hardware to maintain, retrieve and display the images or documents. Of these, the second is the more difficult. Microfilm is the best solution to both of these problems.

Microfilm, properly maintained, lasts for centuries. An image on film may always be read if the user has a magnifying lens and a light source. Formerly the DJA microfilmed court files and indexed them by case number. Retrieval was manual. This same system should be continued, using COM as the method of creating microfilm.

COM:

The recommended ECR storage strategy calls for imaging documents, storing them on magnetic media while they are active, and then writing the images to a Computer Output Microfilm (COM) unit which would make the film from the image file. After the film is checked for quality assurance, the magnetic images may be erased (and/or copied to magnetic tape). If the documents are TIFF images, they may be converted to microfilm images directly. If they are other formats such as HTML or word processing, they must be converted to TIFF prior to the COM step. This conversion is not difficult, in fact it is what happens when a word processing file is Faxed directly from a PC. The Word document is converted to TIFF and then transmitted as a FAX. This step can be automated.

CIC and the ECR Project Manager agree that the COM is the best way to preserve Superior Court files permanently. This should be true for the next ten years. However, an alternative solution may be needed eventually. The weakness of microfilm is that it cannot handle multi-media such as video and sound and may have trouble with color. This is not a problem yet, but it probably will be within a decade.

ISSUE: Is the scanning/COM process the most efficient way to create microfilm of the backlog of closed cases?:

The scanning pilot project was designed to save space by scanning closed cases into an imaging system, with the goal of later converting these scanned images to microfilm by means of COM. A second and probably more important purpose is to gain experience in scanning and in testing concepts. This is a two step process. (1) scan and index the documents. (2), send the files to a COM unit, make film, then erase the magnetic images. CIC has concluded that the experience gained from the scanning pilot project reveals that this is probably not the most efficient or cost effective way to make film images of the backlog of inactive files. It would be more efficient to just film the source documents and skip the scanning process. (This is not true for active records. These are scanned as the documents are filed. The microfilm is created later as a by-product. This is an efficient process).

CIC favors filming directly from the source documents for closed inactive cases. (See recommendation below).

ISSUE: Should DJA acquire and operate a COM unit or should it use a service bureau?

The attached spread sheet (Exhibit 6) shows a comparison between buying and operating a COM unit and using a service bureau. If two FTE are required to operate and maintain the unit, it is probably better to use the service bureau. Another important variable is the price per image the service bureau charges. If it is $.02 per image, it may be cheaper in house. If it is $.015 per image, it may be better to use the service bureau. The price will be negotiable, but CIC believes the County could get it for about $0175, and perhaps a little lower.

Another consideration is for the County to obtain the COM unit and use it for multiple departments. CIC understands that the Department of Records and Elections might be interested in joining with DJA for acquisition of a COM unit.

The least risky strategy would be to use a service bureau for a year or two until the process is perfected, then decide whether to bring the operation in- house. Alpha Information Management, a service bureau with is now providing image COM services to 5 Washington State Counties says it took several months to perfect its process. It is not "plug and play".

Digitizing Film:

Film images can be scanned with a film scanning unit. There are expensive high volume scanners such as Sunrise, and inexpensive low volume scanners which hook on to a microfilm reader printer. When a closed file has been filmed (and there is no magnetic disk or tape file) and it becomes reopened, or if for some reason it needs to be available on-line, it can be digitized and put back into the ECR system. NOTE: Each time an image has been converted from digital to film and or from film to digital, it looses resolution in the process.

Costs:

Magnetic Storage: A NAS fault tolerant magnetic solution would cost no more than the was projected in the budget for magnetic storage.

Digital Tape. Cost were not built into previous budgets and projections for a digital tape library for "near-line" storage. DJA may wish to implement tape storage in 3 years.

COM. The recommended Kodak Image writer will cost about $65,000, including the PC. This is much less than was projected and budgeted for, however it appears that an operator will be needed and perhaps two operators if the process takes more than one shift to keep up with DJA production.

Storage Recommendations:

1. Use magnetic disks as the main media for storing images and electronic documents. Do not use optical storage such as WORM drives or CD ROM's for storage.

2. Consider using third party vendors for magnetic storage. Most storage is not supplied by the server vendor. Cost and performance should be the determining factors.
3. Consider adding digital magnetic tape storage if, in the future it is desired to keep electronic documents on line longer than the present policy. This involves adding a robotic disk library, controlled by HSM software. Tapes would be on-line but slower to access than disks. The cost of tape storage is extremely low, per megabyte.
4. Use CD ROM as a distribution method, not as a storage media. CD ROM can also be used as an auxiliary temporary storage device but it should not be the main storage media.
5. Store ECR documents centrally, in the ITS facility. A secondary storage facility for archival storage could be an exception.
6. Use Network Attached Storage (NAS). Discus with ITS if the possibility of employing a solution which attaches the storage devices to the network, rather than directly to the RS/6000 server. This will allow additional servers to access the storage more easily.
7. Obtain a NAS unit which is fault tolerant. It should employ RAID and have no single point of failure. A NAS unit is proposed. as an example. It fits these requirements and costs $.33 per MB. See spread sheet. Use appropriate RAID configuration, probably RAID 5 or RAID 10. Discuss the RAID options with the storage vendor and image system provider.
8. Buy the NAS unit in stages if possible. This takes advantage of the anticipated price reductions. The NAS unit described in Exhibit 5 can be obtained in two stages.
9. Use microfilm as the storage solution for permanent records.
10. Use COM as the method for creating microfilm from electronic documents. (Except for conversion of backlog, see Recommendation 7, below).
11. Film the backlog of closed cases directly from the source copy. Do not use COM. Scanning inactive closed records and then converting them to film by means of COM is a 2 step process which is less efficient and more expensive than filming from source copy.
12. Use COM to convert the images created during the scanning pilot project to microfilm. Up to 2 million pages will be scanned in this project. These should be converted by means of COM, because the first step in the two step process has already occurred. Use this as a test of large scale COM
13. Acquire a COM unit to make silver halide (archival quality) originals or use a service bureau.

(a) DJA may elect to utilize a service bureau for making the original copies, and avoid the capital, maintenance and operational costs of a COM unit.

(b) DJA should explore the possibility of joining forces with another County department such as Records and Elections who also needs COM, in effect splitting the cost.

(c) CIC believes the most practical and least risky course of action is to use the service bureau for a period of time until the process is perfected, then, after cost benefit analysis, decide whether to bring the operation in house.

14. Use a service bureau to make working copies of the film. Do not set up a facility to do this in-house. It is too expensive and requires extensive environmental investment due to chemicals and hazardous gases.
15. Use an inexpensive microfilm scanner to re-digitize images if necessary. Use of this should be infrequent, so a high cost, high performance scanner is unnecessary.

3. Scanners:

General Discussion:

The main decision will be whether to use a few high speed scanners or many medium speed (desk top) scanners. This affects, or is affected by, the workflow in DJA. If DJA decides to have many people at the front of the process scanning documents, each scanning a relatively small number of documents per hour, there would need to be at least 5 and probably 10 scanners. If, on the other hand, all scanning were to be concentrated it could be batched and scanned by two or three high speed scanners. If archival production (conversion of backlog of closed cases) is continued, at least one additional high speed scanner would be required.

ISSUE: Many desk top medium speed scanners or few high speed scanners?.

Cost of high speed scanners is more than a group of desk top scanners. On the other hand, a few high speed scanners may be easier to administer than many desk top scanners. Ten or more desk tops require ten or more PC's and connections.

Although 2 or 3 high speed scanners are probably easier to manage technically than 10 desk top scanners, managing the batch scanning workflow process may be more complex. The overriding consideration is the management decision by DJA on how it wishes to organize the workflow. If it wants scanning done at the front of the process, then the multiple desk top solution is probably best. If DJA wants to scan later, and concentrate the task at one or two scanners, the high volume scanner solution is best.

Paper handling and reliability:

A prime considerations in the choice of scanner vendors is paper handling ability. The elimination or reduction of jams and the ability to quickly clear jams are major concerns. Robustness is another prime consideration. The expected paper volume is very high, and the machines must be rugged. They must also allow routine changing of parts because of wear. Some scanners are considered "throw away". After one or two million pages, they essentially must be replaced. Scanners for ECR must be proven to be reliable, robust and have a long life.

Desk top scanners.

Desk top scanners such as the Fujitsu 3097 now being used in the scanning pilot project, are rated at 20 - 30 pages per minute. Actual production is almost always less than that because of jams, document preparation, loading of paper, cleaning and maintenance, etc. Depending on the workflow, the clerks doing scanning may have other work to perform, such as cashiering. In that case, it is hard to see how the production volume of each desk top scanner would be any more than 25% to 30% of rated speed or about 400 pages per hour. Assuming 7 hours per day, each scanner could do 2800 pages per day. Therefore at least 10 scanners would be needed to scan the expected 28,000 page daily rate.

Desk top scanners require a scanner server (PC). The PC and the scanner must be connected with either a SCSI or video connection. Fast scanners require a video connection to provide the bandwidth required to move the data created from scanning 80 to 120 documents per minute to the PC. Desktop scanners cost about $6,000 each. Scanner PC's cost about $3,000, including monitor. The Fujitsu 3097 desk top scanners used in the scanning pilot project have proven satisfactory.

High Speed Scanners:

High speed scanners are rated at between 80 and 120 pages per minute. cost between $18,000 and $60,000, plus the PC serves to manage them. The Fujitsu 3099 presently being used is an example of a low cost high speed scanner. The experience of the pilot project was that the first Fujitsu 3099 was not adequate. However, a replacement 3099 was obtained which functioned much better. The first one evidently was a "lemon". Much of this difficulty is due to the fact that documents in DJA files have been folded and punched for pinning into folders. This is a challenge for scanner paper handling systems.

As an example of a similar system, the Washington State Department of Labor and Industries (L&I) has an equal or slightly higher volume than DJA. L&I chooses to scan all its documents in large batches using 3 high speed Kodak 930 series scanners. L&I also has 2 Fujitsu 3097 desk top scanners for incidental scanning. lei's investment in the 3 scanners and the 3 Sun workstations is about $300,000.

The L&I system is a high price system which cost at least $16 million plus 1 million for systems analysis and design. L&I feels it needs 3 scanners for peak workload periods and for when one of the scanners is being serviced. King County DJA does not have that kind

of capital to invest ECR system. Each L&I Kodak scanner and attached Sun Server cost about $100K.

On balance, CIC favors a combination of high speed scanners and multiple desk top scanners. This provides more management flexibility and is cheaper. Ten desk top scanners cost about $60,000 plus about $30,000 for PC's and SCSI connections. One Fujitsu or Bell and Howell high speed scanner plus video card and PC costs about $30,000. at L&I. (Kodak has an intermediate range of scanners, costing about $40,000 but the paper handling ability in comparison with the high end product is unknown). The Kodak scanner would probably be needed if archival scanning were to be continued. Otherwise less expensive scanners such as Fujitsu 3990, Bell and Howell, or a less costly Kodak would serve.

If archival backlog scanning is to continue, CIC recommends that the additional Fujitsu 3099 high speed scanner recently acquired be used for that purpose, as well as for scanning of active documents.

CIC recommends evaluation of scanner quality based on the procedures in ANSI/AIIM MS44, "Recommended Practices of Quality Control of Image Scanners" to ensure suitable image quality.

As stated in Recommendation 6, below, CIC recommends 200 dots per inch for textual documents and 300 for maps engineering drawings and very small text. This is based on experiments conducted by CIC, DJA and Fred Westfall of Weyerhaeuser Corporation. These are also considered "best practices" within the document management industry.

Cost:

If high end, high volume scanners are selected, the cost will be higher than projected and budgeted for. If multiple desk top solution is chosen, there will be little if any cost difference in budgeted projections.

Scanning Recommendations:

1. DJA should analyze its desired workflow. If it prefers scanning be done early, as documents come in, and the scanning be done by people who are also doing other things such as cashiering, then it should adopt the multiple desk top scanning solution. If it wishes to scan later and concentrate the operation, it should adopt the high volume solution. Discussions with the Project Manger reveal that the desired configuration will be a combination.
2. DJA should acquire a combination of high speed and desk top scanners: There should be at least 2 high speed scanners, one located at the KCCH and one at RJC. These will be used at the points where the majority of documents are filed so that scanning can be concentrated. Desk top scanners will also be needed at places where lower volumes of filing (scanning) will be done. There will be at least 10 of these.

3. DJA should ensure that its scanners are rugged and reliable. Strict specifications should be built into the RFP as to "Mean Time Between Failures" (MTBF) and guaranteed numbers of pages that can be handled during a duty cycle.
4. DJA should ensure that the scanners have excellent paper handing qualities They be as free of jams as possible, and jams must be easy to clear. These requirements should be built into the RFP.
5. DJA should follow ANSI/AIIM MS44 procedures to ensure image quality.
6. DJA should require a scanning density of 200 dots per inch (dpi) horizontal and vertical for textual documents and at least 300 dpi for engineering documents, maps documents with background detail or small type.

4. PC's (Workstations):

General Discussion:

The King County standard for new PC's should be adequate for ECR. Costs have been declining rapidly as performance has been increasing and any new PC should be ECR capable (except possibly for the monitor). "Thin clients" designed for Intranet use should be usable for ECR.

Cost:

Cost of PC's will be no higher than projected and budgeted.

Recommendations for PC's:

1. PC's for ECR should be at least at the following standard:
   - Pentium II 233 MHz CPU
   - 32 MB of RAM. New PC's now usually come with 32 MB RAM.
   - Disk space should at least 2.5 MB.
   - Intel mother board with 512K of cache
   - 2 MB PCI Video Card, appropriate card for monitor
   - Mouse
   - Keyboard
   - Windows NT or Win95 (See software section, below)
   - 10/100 Network Card

2. Monitors should be 20" to 21" color for "heads down" users. Refreshment rate should be above 70 Hz., non-interleaved. Frequent users need at least 17" color monitors. Occasional or infrequent users should be able to use 13" color monitors.

5. Printers:

Laser printers attached to the LAN or directly to a PC should be adequate. Print accelerator cards installed in the printer may be necessary to get acceptable print speed. Print speed should be at least 20 pages per minute.

Recommendation: Leave the choice of print accelerators and printer configuration up to the successful vendor.

6. LAN/WAN Requirements:

The King County WAN structure is capable of supporting the ECR system, especially on the "A" sites which are connected to the ATM backbone. The WAN is operating at only a few per cent of its capacity.

7. CD Writer:

A number of inexpensive CD writers are available. Rely on the contractor or LAN Manager for advice.

E. SOFTWARE:

General: The ECR application may be described as an electronic document or imaging system with workflow. The application is supported by various other software such as routines for uploading index or docketing data, Fax server modules, OCR, bar code reading, hierarchical storage management (HSM) and operating systems. These are described below.

1. Imaging System (EFM):

The imaging system software, better described as an Electronic Folder Management (EFM) is the heart of the ECR software system. It accepts, manages, indexes, stores, retrieves displays and outputs electronic documents. The EFM system should be the manager of all documents of every type. It will provide an independent repository for the *Documents of Record*. The virtual folders and sub-folders must be able to contain TIFF images, HTML, PDF, Word Processing, ASCII and other document types. This concept will allow for the grouping of documents by case (unit record). Whether documents are filed all at once or piece by piece over an extended time, they are grouped by the virtual case folder.

Imaging (EFM) systems are not "plug and play" off-the-shelf programs. They are complex systems containing hardware, standard software and customized software modules. Some vendors describe their imaging software as "software tool kits". That means that someone must write programs that string the "tools" together to make an application that fits DJA needs. Some software modules may be supplied by multiple vendors. As DJA experienced in the scanning project, software was installed in pieces, tested, modified and reinstalled, in order to get the system to work. This is not unusual. Software will contain bugs, and when these bugs are fixed, new bugs will result which in turn will need to be fixed.

The requirements of the EFM system will be described below in the following categories: Input, Indexing, Display, and Storage

⇒ **INPUT:**

(1) Scanning: Imaging system must include scanning software. All major imaging systems include scanning software modules. This software is loaded onto the scanner server, usually a PC but can sometimes be a RISC workstation. The software controls the scanning process, receives the file from the scanner, displays the image for quality control, compresses the image and often does indexing, or preliminary indexing. There is usually a batch process routine which allows images to be scanned in batches for better control. Bar codes can be read during the scanning process.

ISSUE: Scanner control through hardware or software?

Scanners can be controlled in two ways: (1) by software, as described above, or (2) by hardware. Hardware control means that a special card called a video card is installed in the scanner. The video card also controls the connection of the scanner to the PC. Scanner cards perform many scanning functions and do them very fast: Scanning, de-skewing, de-speckling, elimination of unwanted boarders, rotating images, indexing, bar code reading and others.

Pro: Hardware systems are very fast.
Con: Scanner video cards are expensive. In the case of a desk top scanner, they cost as much as the scanner.

CIC tends to favor software control because PC's are becoming more powerful and cheaper. The relative advantage of the hard card is decreasing. However, CIC believes that DJA should follow the vendor's recommendation in this matter.

Duplexing means that both sides of a document are scanned at the same time. Less than 15% of documents filed with DJA are dual sided. The rule of thumb is that when less than 15% are dual sided, duplex should not be used. Documents are scanned on one side, then turned over for the second pass. Or, as DJA has been doing in RJC, a Xerox copy of the second side is made during document preparation.

Image File Headers and File System

CIC recommends that standard, non-proprietary image file headers be used. Since even some standard headers such as Tagged Image Format (TIFF) are available in a variety of implementations, the vendor should supply a detailed definition of the image file header structure employed. If a proprietary header is used, the system must provide a bridge to ANSI/AIIM's non-proprietary header label standard, ANSI/AIIM MS53-1993 "Standard Recommended Practice; File Format for Storage and Exchange of Electronic Images".

MS53 specifies a Tagged Image File Format (TIFF) Bi-Level format for applications that require file transfer across different platforms. The standard defines a format for a file containing one page with one image. If not provided by the supplying vendor, CIC recommends that the County procure software, to effect output for each document image index data in ASCII, either comma or record delimited into a flat file and image data into MS-53 format.

Compression Techniques

CIC recommends Consultative Committee on International Telegraphy and Telephony (CCITT) Group 3 or Group 4 compression techniques without proprietary alteration to the algorithm, as this standard is currently the industry norm. CIC notes that JBIG (Joint Bi-Level Imaging Group) compression is a standard (ISO/IEC 11544:1993) and an acceptable alternative to CCITT. JBIG is supposed to be more compression-efficient than G3 or G4 (achieves ratios of 10% to 50% greater than Group 4) and can compress both gray scale and bitonal images. Vendor and user adoption of JBIG has been slow. If the use of a proprietary compression algorithm is unavoidable, then CIC recommends that any system provide a bridge to Group 4 standards or any compression standard subsequently adopted by ANSI.

Scanning Functions-- DJA should require that the scanning system perform:

- Basic scanning.
- De-skew. (if a page is scanned at an angle, it can be straightened or de-skewed by software). This saves storage space and increases OCR accuracy.
- Rotate. If it is better to scan pages upside down, software should reverse them.
- Replace defective images before submitting (committing) images to the system. Defective images can occur because of jams, wrong resolution, wrong document scanned or other reasons. Must be able to easily replace.
- Compression. Done at the scanner or scanner PC.
- Ability to change resolution “on-the-fly”. (for example change from 200 dpi to 300 dpi).
- Removal of spots (noise) and unwanted borders. This can be done in software but more often using hardware.

Vendor should show how the scanning system software works. What kind of scanning display window will be provided? Vendor must show how batch scanning routine work, and how one of a kind routines function. Vendor should show how corrections are made.

Quality Control: Vendor must show how quality control of images is done. Real time or batch?

Scanning Software Recommendations:

1. Software requirements in the RFP should be expressed in terms of performance. Performance to be expressed in terms of required functions and speed. Leave to the vendor how to fulfill these performance requirements.
2. Scanning Functions should be listed as desirable or mandatory on the RFP. Functions listed above such as de-skew should be evaluated by DJA to see what is most important or critical. These should be put in the RFP as desirable or mandatory items and negotiated with the vendor during contract process.

(2) FAX: The system must provide for FAX documents to be input into the imaging system as if they were scanned locally. Faxed documents will entered into a workflow queue just as imaged documents. Alternatively, there could be a queue of faxed documents so that as an action step or task, DJA clerks can inspect them, index them, and enter them into the system. See Workflow.

(3) Electronic Input: Electronic input is not part of the core system. Nevertheless, DJA should insist that the vendor be able to accept documents in electronic format. These should include HTML, XML, Word Processing, smart forms or ASCII. The vendor should demonstrate how this would be done. Probably these documents should be entered into a workflow queue. Quality control and docketing (perhaps the same step) would be steps along the queue.

Quality Control. How will electronic images be captured, placed in queues, and presented to clerks? The .

Translation. If DJA decides to standardize on a few electronic document formats, but must receive other types not supported, it will have to translate the formats into formats it will support. (Example: San Francisco Superior Court receives word processing documents and plans to translate them into TIFF image files. Federal bankruptcy courts translate all formats into PDF.) Translation software will also be needed when converting electronic (non-image) forms to COM. This capability will not be needed immediately but the vendor should show how translation software could be incorporated into the system.

(4) Scanning from Microfilm

This capability will be needed later. Vendor should demonstrate how this would be done.

⇒ **INDEXING**

Indexing in ECR is in two categories (see Section B of Architecture, Functional Performance Requirement, above):

(a) Indexing documents and pages into the ECR system which is automatic, and

(b) Docketing, meaning entering data into SCOMIS, done by docketing clerks now, and in the core system, but semi-automatic in later phases when intelligent documents are filed, with machine readable index (docketing) terms.

Indexing is a critical part of the system. Without indexing documents and pages into the system (category a), documents cannot be found or retrieved.

Indexing can be very expensive. DJA now has 40 clerks performing indexing (docketing) functions. It is a key goal of the ECR to reduce the cost of indexing. SCOMIS will act as the main index. DJA must determine what index data elements will be captured by the imaging system. This should be listed in the RFP.

In later phases of ECR, indexing and docketing will be semi-automated. There are a range of methods of automatically or semi-automatically entering index data, including:

- Bar Coding: Bar coding is being used now to index documents to the SCOMIS number. The system scans bar code version of the SCOMIS number printed on the header sheet placed before each case. After capture, the SCOMIS number is used to index each page.
- Optical Character Recognition Systems (OCR): Also known as Intelligent Character Recognition (ICR), OCR converts "dumb" images to machine readable characters and words. OCR potentially can convert index terms in documents to a form which can be uploaded into SCOMIS or other systems.
- OCR for Forms. An application of OCR in which the software registers zones (boxes) in a form and converts the typed or hand-printed (constrained hand print) data in the box into machine readable data and enters the data into a data base. Such a system must allow DJA staff to enter any number of forms into the system. The system must be "trained" on each form. This system really only works with standard forms.
- Word Processing Documents: Index data can be entered into the "properties" of a document (For example Word documents have a properties section to be completed when saving a document). A visual Basic program can be written to capture the index data in the properties section and automatically enter it into a buffer screen where it could be quality control checked by a docketing clerk and then passed on (by means of another software program which must be custom written) into ECR and/or SCOMIS.
- Smart Forms: Smart forms are forms which appear on the document originator's PC screen. The forms could include index or docketing data. Completing the box on the form completes the document. Upon electronic receipt or this document by the Clerk, the data is automatically entered into a computer system (or buffer screen prior to uploading onto SCOMIS). Since the index data is already machine readable, it does not need to be printed out, scanned, or OCR'ed. Smart forms are already used by several courts (see Deliverable #6). Smart forms can be used within the county as part of workflow, or exterior to the County via the Internet. There are HTML versions of smart forms.
- Post Processing Edit Checks: OCR software makes extensive use of post processing edit checks to increase accuracy. For example, a rule could be that a name field must be alpha and

not numeric. Thus if the system can not tell if the second character of the name "Slade" is the letter "l" or a number 1, the edit check rule will resolve it. There are high speed editing checks that compare street and city addresses with zip codes to resolve uncertainties. In the US Postal Service these operations are performed at the rate of 15 per second. A local OCR company, RAF Technologies Inc., has developed post process edit checks to a very high accuracy. RAF has realized that these post processing edit checks are just as valuable for data coming in as smart forms or HTML as for data extracted from the OCR process. The RFP should address the above methods of extracting data and require that the vendor describe their solutions.

Indexing Screens: The DJA should provide examples of SCOMIS docketing screens in the RFP. Vendors should show how they would present the ECR index windows alongside the SCOMIS window and the general method by which docketing clerks could enter data in ONE WINDOW only and have it actually simultaneously enter data in ECR system and the SCOMIS system.

Docketing Upload Software: No matter what method is used to capture index (docket) data elements, custom software must be developed to upload the index data into SCOMIS, which will ultimately greatly reduce the docketing workload. This software should be designed with the advice and cooperation of the Office of the Administrator of the Courts (OAC). OAC staff want to be part of the process. They are supportive of automated uploading but are concerned about accuracy (See Deliverable #3 for interview with OAC on this subject).

⇒ VIEWING

- Access Screens: DJA should decide how staff and customers should look up documents and how the documents should be presented. Basic decisions on this should go into RFP and/or be determined at time of negotiation.
- Annotation: Does DJA want the ability to annotate documents? Red line, highlight, electronic sticky note? If so, state in RFP.
- Read Only: Some image display software is "read only". Nothing can be modified. Others display software permits updating, annotating, and routing in a workflow. Public access workstations for example should be read-only. Usually the cost, per seat, for read-only is less.

⇒ STORAGE

- Foldering Requirements: Will there be sub-folders? Will each folder be indexed?
- Check-in, Check-out: This is a library "circulation" type function. It is also a document management function. DJA should determine if this function is needed. CIC believes it is not needed.
- Retention Requirements: Superior Court Records must be retained permanently. It is on this basis that all documents in each file have traditionally been filmed and the film retained permanently. However, CIC and the DJA Project Manager believe that although the files

must be retained permanently, many documents in the files should not be retained. What goes into the file can be managed. Sidney McAlpin, a CIC associate and former Archivist of the State of Washington believes this to be true and has advised that the rules be changed to permit selective weeding of certain kinds of documents. DJA should urges that the Washington Association of County Clerks evaluate the content of case files and recommend appropriate legislation.

- HSM: Hierarchical storage management software will probably be needed. This may be provided by the imaging vendor or by a third party. HSM will be needed to automatically move documents from active storage to optical or COM. It could also be used to move documents to a cache server, if that feature is used.
- Sealed Records: CIC does not know how DJA plans to deal with sealed records. DJA should decide on a strategy before releasing the RFP.
- Access: The Electronic Folder Management (EFM) system must provide selective access to documents that are closed. Access must be controllable at the Case, Document, and Page level. Some systems provide even part of a page black out. DJA must put these requirements in the RFP.
- Records Disposition: DJA may need to erase records. This may happen because of a court order to expunge records, or because the electronic documents have been converted to microfilm and DJA needs to erase them to save space. DJA needs the ability to erase. Some imaging systems do not have this ability because they have written the images to optical WORM (Write Once Read Many) which cannot be erased. Other vendors feel that the inability to erase is a "protection" and adds to the authenticity and reliability of the system. DJA does not want to be protected against itself.

Retention Recommendations:

1. Active cases should be on magnetic disks and inactive cases should be converted to microfilm by the COM process for permanent retention. (As described above).
2. DJA should request that the Washington State Association of County Clerks evaluate the contents of case files and recommend appropriate legislation.
3. DJA should have the ability to erase files. This ability should be controllable by DJA so that only selected staff can do this.

2. Workflow Software

Workflow software is essential to ECR. Workflow simply defined is a sequence of actions or steps used in business processes. Workflow specifically defined as software means intelligent routing of documents and data. Workflow systems take a process, its related tasks, and the route that the information follows, and automates it. When automating a process, process designers must determine what is important to the process, understand the roles that people perform, the technology infrastructure and the information that will be used.

Electronic workflow applications are most productive in high volume, repetitive activities. Workflow applications improve productivity by eliminating lag time and improving control. Workflow applications reduce the time that it takes to do an activity, both elapsed time and total time expressed in production per hour.

The application characteristics of Routes, Rules, and Roles are much more definable and specific in a workflow application than in an average groupware application. So, an information sharing groupware application becomes a workflow application when a specific route is defined (e.g. A->B->C), specific roles are set (A- cashiering, B-scanning C-indexing) or (A-prosecutor, B-reviewer, C-indexing) and specific rules are in place.

The concept of a queue is also critical to workflow implementation. A queue functions as nothing more than a waiting line, similar to those that occur at a fast food restaurant, stop sign, or an airline check-in counter. As applied to DJA, documents are filed or received or filed, wait if necessary in a queue or a series of queues (what were piles or stacks in the paper based operation), approved, scanned, indexed, quality controlled etc. Service may occur first-come, first served, (also called FIFO, first -in first-out), or according to established priority.

For the core system, workflow will be necessary to move images from multiple scanning stations to the indexing stations, from indexing to quality control and to storage. For later stages of the ECR system, more complex workflow will be needed. For example images to or from the jail may be workflow applications. Electronic filing of documents by the Prosecutor may occur via workflow. Workflow may or may not require a separate server.

DJA Workflow: A workflow (W/F) system is a computer based technology that:

- Logically and sometimes physically moves documents and related data,
- Is not restricted to digital or electronic imaging.
- Many times people use the term “workflow” when they mean “folder management” or “work management. In the case of ECR, requirements go beyond folder and work management.

Levels of complexity in W/F systems:

- Ad Hoc (Intelligent e-mail). Not really workflow (how can you tell if the work is done? In e-mail you just know the next stop, not the whole defined route).
- Groupware systems: Lotus Notes and Novel Groupwise are examples of high end groupware. Groupware type workflow systems usually work best in small work groups up to 10 or 12 users.
- Transaction (Image only)
- Object Oriented (multiple objects) This would allow documents in various formats (Images, Word, Excel, HTML, and ASCII) to be moved through the workflow routes.
- Knowledge Based

Based on this complexity hierarchy, ECR will require an object oriented W/F because it will need to move images, objects, and data in the workflow work packets. It must be above the level on an Ad Hoc or groupware system because of volume.

Levels of robustness in terms of volume and complexity: Robustness or Scalability is determined by volume and complexity, as shown in the chart below.

VOLUME	COMPLEXITY
Low	Low
Low	Medium
Low	High
Medium	Low
Medium	Medium
Medium	High
High	Low
High	Medium
High	High

If the ECR system were to use workflow only to move images from input to indexing and quality control, the system could be defined as high volume, low complexity. But if the system must move documents from multiple scanning stations, to and from judges and court rooms, from the Prosecutor, to and from the jail, etc., then the system nay be described as High volume, Mid-complexity, as shown above.

Volume Considerations: Realistically, the major volume trade-off consideration involves whether a messaging-based or production workflow tool will best satisfy the needs of ECR. Production workflow generally means 10,000 transactions per shift. DJA files about 7,000 documents per day. Since they must be scanned, docketed (indexed), quality controlled, and sent to file, ECR will be pushing against the upper limit of messaging-based workflow.

However, it is certain that performance of messaging-based workflow tools will be increasing. CIC believes that the trend in the marketplace is toward messaging-based workflow products and that the performance improvements will continue. The trend is being driven by mass adoption of Lotus Notes and Microsoft Exchange for messaging infrastructure in conjunction with the explosive rise of the Internet as a mainstream technology providing universal connectivity. The emergence of robust, flexible, inexpensive messaging servers with rich programming interfaces augurs well for messaging-based workflow. Notes is currently the market leader with Exchange gaining ground quickly. Messaging-based workflow technology costs several hundred dollars per seat whereas production workflow software costs over $1000 per seat.

Doculabs, an independent testing laboratory, has published that it anticipates messaging-based workflow tools to grow quickly and develop the ability to handle higher volumes. Bruce Silver, another noted consultant, in the November 3, 1997 issue of Knowledge Management World,

stated, "Don't think of it as electronic mail. Before long it's going to be the foundation of your document and work management strategy".

Examples of Production workflow products are: Staffware, Plexus, InConcert, and IBM's Flowmark, to name a few. The disadvantage of production workflows are cost per seat, implementation and integration complexity, and high personnel skill set requirements.

Examples of message-based workflow systems based on Microsoft Exchange are Keyfile, Jetform, FileNet, Eastman Software (formerly Wang), and Viewstar.

The trade off between message-based workflow and Production Workflow is similar to that between NT and UNIX. UNIX and Production Workflow are more powerful and more expensive. NT and message based workflow are less expensive and gaining in power. The question is: Will the less expensive solutions be powerful enough in the next year to support the load DJA's workload volume requirements?

The RFP should address this issue in terms of performance requirements: volume, number of routes, number of transactions. Vendors can respond with suitable workflow technology.

Routes:

A route is a predetermined path that a document or work packet must pass through. A workflow product must permit the definition of various routes depending on requirements. In addition to pre-determined routes, there needs to be the ability to override the route based on a worker or supervisor's decision. In other words, there must also be ad hoc capability.

Indexes (not the same as indexing the images):

How will work packets containing scanned images be indexed during the workflow process, assuming that a SCOMIS number has not yet been assigned? Will there be a temporary number?

Workflow Task Types:

A task is an action step on a workflow route. For example a task could be scanning, data entry, quality control, and commitment to the system for storage.

- Decision: Document arrives in a queue. Clerk makes a decision about the document of process on a workflow screen. Forwards to proper route, depending on the decision.
- Split: Parallel processing can reduce elapsed time. Document is copied, and copies are routed simultaneously via two or more routes.
- Merge: Parallel copies of documents are reunited and reduced to one copy. Or, a document must wait at a merge queue until another document arrives and is joined up with it.

- Hold: Document must await some event before it can be processed.
- Data Entry: Example: Workflow presents image of document to docketing clerk in ECR window. Clerk types SCOMIS number. Workflow automatically looks up the SCOMIS case and brings the SCOMIS window on-screen. Presents data entry screen, accepts index data. After OK by clerk, up-loads to SCOMIS. Brings up next document.
- Print: Print document or data
- Down Load: Workflow can be used to download selected documents to CD's, to COM, to the Internet or other destination.

Work flow development and modification tool.

1. DJA should require a "point and click" graphical interface which would allow DJA to create or modify applications, routes, tasks etc. with no or minimal writing of code.
2. The tool should be connected to a library of functions so that the application or modification is actually written by the point and click interface. Some workflow graphic user interfaces are really mapping and flowcharting tools which do not really build the application.

Workflow Standards:

The Workflow Management Coalition (WfMC) is working on 5 sets of APIs (Application Programming Interfaces) for workflow. These might be listed in the RFP:

1. Process definition interface, a standard definition between the process definition tool and the workflow engine,
2. The work list handler interface, which are standards for the workflow engine to maintain work items that the work lit handler presents to the user,
3. The tool invocation interface which would let the workflow engine invoke a variety of external tools, such as e-mail, document retrieval or user written applications,
4. Process interoperability, a variety of interoperability models that would let disparate workflow products inter operate and share the responsibility of managing a workflow process, and
5. The administration and monitoring interface is an interface for administrative functions, such as collecting and storing key data about workflow.

Microsoft and Wang (now Eastman Software) partnered to develop the first implementation of the "Interface 4 specification" called the MAPI Workflow Framework (MAPI-WF). In the near future, expect to see a universal standard emerge to allow messaging systems to serve as the back bone between multiple workflow systems across departments or across companies. CIC recommends that DJA, in its RFP, solicits vendor support for WfMC standards and attach weights for above numbered items 2, 4, and 5 as these items are Most important for reducing vendor lock-in. WfMC is an obvious emerging standard.

Workflow Recommendations:

1. Workflow software should be evaluated based on performance requirements. The RFP should contain information about the probable number and type of work steps and the number of routes. It should provide an estimated number of transactions at each step per shift. Vendor should demonstrate that the proposed software has handled equivalent workload in other locations. Such locations should be referenceable.
2. DJA should determine the minimum task types it requires. These should be built into the RFP.

3. Operating Systems

(a) Server (covered in Hardware Section, Main Server, above)

(b) Work Stations.

Ideally the ECR system would be able to function whether the client workstation is running NT Client, Win9x or Windows 3.1. This would provide maximum flexibility for users.

However, CIC recommends that the first choice for ECR client workstations be NT. NT costs about $150 more per copy than Windows 95 or Windows 98, requires more RAM (32 MB) and cannot run all DOS and Windows 3.1 applications. NT has better memory management than Windows 9.x. NT and Windows 9.x are converging and it will be more cost effective in the long run to migrate to NT initially rather than to face conversion in the future.

4. Data Base Management Systems (DBMS).

Most imaging systems use a DBMS to manage images. The DBMS is usually a general purpose system such as Sybase, Oracle, Informix or Microsoft SQL Server. The DBMS contains pointers which point to the images or other electronic documents, whether they are on magnetic, optical or other storage media ImageX is an exception. It uses a proprietary image manager called "MINDS" which is simple, yet fast and can manage a very large number of images or other electronic objects.

An argument for using a DBMS rather than a proprietary system is that it is more open and therefore less dependent upon a particular vendor. An argument against it is that a DBMS is expensive. Each "seat" must be licensed. Another argument against the DBMS is that is tends to be slower. Since a DBMS is a general purpose system, it has more overhead. MINDS does just one thing, and is very efficient at doing that one thing.

If a proprietary system such as Minds is used, DJA should require an exit path built and tested in advance.

If a DBMS is used, CIC recommends a system that complies with Structured Query Language (SQL) standard. Each SQL compliant DBMS has a different way of handling the functionality that goes beyond the SQL standard. CIC recommends against using any proprietary extensions that may be supplied with and SQL-compliant DBMS. CIC recommends that any stored

procedures be implemented in C, C++, COBOL, Visual Basic, or Java, as all of these languages have wide adoption (or in the case of Java, soon will soon have wide adoption.

5. Miscellaneous

The proposed image enabling architecture is based on a screen level integration. The client PC will require a 3270 emulation for SCOMIS. CIC recommends Rumba, manufactured by Wall Data with allows simultaneous connections with multiple hosts. However, if DJA, the County, and OAC use another emulation package, that should take precedence.